Fire suppression for heavy plant & machinery.

Plant and machinery are used in most heavy industries such as mining & quarrying, forestry, waste & recycling, logistics, construction and agriculture.

This equipment will commonly be powered by internal combustion engines or hydraulic power packs and will be of a mobile or static configuration. Mobile equipment includes the likes of excavators, wheeled loaders and cranes whereas shredders and electrical generators are most often considered static.

Fires on heavy plant & machinery

What are common causes of fire on heavy plant?

Heavy plant fires are commonly caused when combustible debris or flammable liquids meet a superheated surface such as turbochargers, other exhaust components, braking systems or seized bearings. Combustible fuel sources can build up naturally over time whilst working in and around environmental debris such as wood chips, household waste and coal dust, whereas flammable fuels could be the result of a damaged or defective hydraulic or fuel line.

Electrical short circuits may also result in a fire scenario commonly caused by faulty or damaged wiring or components.

What are the consequences of not protecting heavy plant from fire?

Precious minutes spent waiting for emergency services is all a fire needs to take hold, destroy a piece of plant and cause consequential damage to its surroundings. First and foremost, the safety of operators must be the number one consideration. Additionally, damage caused to heavy plant by fire can be devastating, often resulting in large insurance claims for replacement equipment as well as significant business interruption.

Why is fire suppression needed for heavy plant?

Heavy plant fires do happen. The risk of fire is always present due to the large amounts of flammable liquids used on a piece of plant, numerous ever-present ignition sources, high operating temperatures and arduous working conditions.

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How are fires suppressed on plant and machinery?

Knockdown: The key to minimising damage caused by a fire is fast and effective knockdown of the flame. This is achieved by quickly introducing a fire suppressant agent and breaking the chain reaction by removing oxygen, heat and fuel from the area.

Cooling: Today, most heavy plant utilise turbo charged diesel engines to power the machine. Unfortunately, one by-product from a turbo charged engine is extreme heat (above 1,000°C in some cases) and whilst Dry Chemicals are effective at flame knockdown, they cannot provide the cooling needed for equipment such as turbo chargers.

This means reignition can occur when flammable liquids meet extremely hot surfaces after the Dry Chemical discharge has ended. The use of an effective liquid based cooling agent is essential to reduce the temperature as quickly as possible of superheated surfaces below the ignition point of the flammable fuels to prevent fire re-flash.

Fire suppression systems

A fire suppression system for heavy plant is a self-contained system specifically designed to protect heavy mobile and static equipment from fire. The system will be responsible both for detecting and for suppressing a fire in its early stages and will be made up of the following elements.

Fire suppression system elements	
Control and detection	The control and detection element of the system is responsible for the detection of a fire and automatic actuation of the suppression agent. It should possess the following features as a minimum: > The control system must provide 24-hour supervision of the machine and itself. > A display module must be in view of the operator for clear communication of a fire alarm or system fault. > The operator must be able to manually activate the system. Manual actuation points should be available in the cab, along the path of egress and at ground level. > The control system must have the ability to shut down the engine prior to system discharge to stop the flow of fuel, vent pressurised hydraulic systems and stop the cooling fan. > Automatic Fire Detection should be installed as part of a control system on all plant and equipment where an operator has no easy visual indication of a fire related incident. This is particularly necessary when the engine compartment, which is often the main fire hazard, is either behind or underneath the operator.
Suppression	Suitable extinguishing agents should be chosen for the hazards determined as part of a fire risk assessment. Dry Chemical, Liquid Only and Twin Agent systems all have their place in vehicle fire protection. > Dry Chemical extinguishing agent comprises of a finely divided powdered material, designed to provide rapid flame knockdown. There are several types of dry chemical extinguishing agents available, each having its own distinct capabilities. > Liquid Only systems are commonly aqueous solutions discharged in a liquid state. Traditionally used only as a cooling agent, but some modern technologies are designed to allow liquid only systems to operate both as a suppressant and a cooling agent. > Twin Agents are a combination of the two whereby the dry chemical will provide flame knockdown and the liquid will cool superheated surfaces. Upon system actuation the agent will be discharged from the agent cylinders into the hazard areas via a distribution network of hoses and nozzles. **Note -** all control, detection and suppression components must be supplied by a single approved manufacturer OEM and installed by an approved installer, trained and holding up to date certification.

Approvals

Third Party approval testing is essential. It covers everything from the strength and durability of the support brackets through to the performance of the complete system in various fire tests. The tests cover the sum of all the components tested individually and then collectively as a system*.

The following approvals are industry recognised and accepted.

- FM 5970 - Heavy duty mobile equipment fire protection systems.
- AS 5062 – Fire protection for mobile and transportable equipment
- SPCR 197 – Fire detection systems in engine compartments of heavy vehicles
- SPCR 199 – Fire suppression systems in engine compartments of heavy vehicles

* If a system approved by SPCR is being considered, systems which hold both 197 and 199 certifications should be selected to ensure both detection and suppression elements have been tested and considered fit for purpose.

Specification and risk assessment

A suitable specification and effective system design will be determined following a detailed fire risk assessment undertaken of the item of plant by a trained fire suppression engineer. All foreseeable risks should be identified and the appropriate solution selected for the detection and suppression of any fire related incident.

The risk assessment focuses on identification of fuel and heat sources within the item of plant as well as external environmental risks. As fire is made up of fuel, heat and oxygen it means a fire hazard exists in any place that these three elements could be brought together.

Maintenance	
Regular Inspections	A heavy plant fire suppression system must be maintained in accordance with the manufacturer's guidelines and done so by trained personnel only. A system should typically be serviced at six monthly intervals or sooner depending on the environmental conditions. The Control, Detection and Suppression components will be thoroughly examined to give maximum assurance that the system will operate effectively and safely.
Post discharge	Following automatic activation of the system, the first concern is to determine the root cause of the system discharge and to have the problem corrected before rearming the fire suppression system. Recharge of the fire suppression system must be carried out by trained personnel only and this will generally consist of testing and resetting the detection and control systems, refilling of the agent tanks and ensuring the distribution network is free of any blockages. Various components will be replaced as part of a system recharge such as detection, the agent and any other parts affected by the fire. **Note –** following a discharge the item of plant must not be returned to work until the system has been recharged and repaired if necessary.

Operator responsibilities

Operators should receive training on the operation of the fire system from the company responsible for installing the system. They should also be made aware of the following points.

> Be aware of the fire system and how it works.

> Basic visual checks of major fire system components should be included as part of the operator's daily inspections.

> It is essential to follow the maintenance guidelines of the plant manufacturer to reduce the risk of components becoming faulty and causing a fire.

> How to properly clean the plant regularly to avoid a build-up of combustible materials.

> Ensuring that alternative firefighting equipment is available on site in case the system does not totally extinguish the fire. Hand portable fire extinguishers must always be available to supplement an automatic fire-fighting system.

Summary

Due to long hours spent working in harsh environments, fire on heavy plant machinery is a real and ever-present danger to operators, equipment and its surroundings.

This risk can be significantly reduced with the installation of an Approved heavy plant fire suppression system protecting the plant from damage and keeping it in operation.

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